

# ACCELERATING PARTNERSHIPS FOR COMMERCIAL IMPACT



The 2019–20 Progress Report celebrates the power of Los Alamos National Laboratory partnerships to deploy innovations into the market to improve the country’s economic potential and national security. We celebrate those initiating:

- advances in verification capabilities for the nuclear safeguard community;
- new ways to increase the production and use of biofuels as a cleaner energy source;
- the transition of high-performance random number generator critical to the evolving quantum hardware market;
- New Mexico start-up efforts focused on powering deep space exploration; and,
- identification of customer and market needs for better solutions to detect viruses more accurately and rapidly.

The Richard P. Feynman Center for Innovation is building on these successes through engagement with partners committed to the commercialization of Laboratory technology, the growth of regional and national high tech economies, and the enhancement of our national security competencies.

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# INNOVATION IS POWERED BY PEOPLE

The Richard P. Feynman Center for Innovation - Innovation Honor Society recognizes outstanding Los Alamos staff who have exceptional and longstanding contributions to scientific discovery, innovation, and technology transfer. The criteria for induction include overall engagement in collaboration projects, protection and deployment of intellectual property, and other innovation indicators. This year seven inductees met that threshold and will be inducted into the Feynman Center Innovation Honor Society.

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- Nathan Moody:**  
AOT-AE: APPLIED ELECTRODYNAMICS

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  - Derek Aberle:**  
P-1: DYNAMIC IMAGING AND RADIOGRAPHY

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  - Daniel Seitz:**  
A-3: TECHNOLOGY APPLICATIONS

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  - Boian Alexandrov:**  
T-1: PHYSICS AND CHEMISTRY OF MATERIALS

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  - Raymond Newell:**  
MPA-Q: MPA-QUANTUM

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  - Yu Seung Kim:**  
MPA-11: Materials Synthesis and Integrated Devices

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  - Adam Warniment:**  
A-3: TECHNOLOGY APPLICATIONS
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# Entrepreneurial Spirit

Jessica Kubicek-Sutherland

## Innovation

Jessica Kubicek-Sutherland – (C-PCS) started her journey in 2017 through DisrupTECH, exploring opportunities with the Chemistry Division's Chemistry for Biomedical Applications (CBMA) team's Universal Bacterial Sensor - a sensor that mimics biological recognition of bacterial pathogens to quickly detect infections. After DisrupTECH she continued pursuing commercialization strategies for the sensor during the first cohort of the UC/LANL Postdoc Entrepreneur Fellowship in targeting an application for diagnosing sepsis directly from blood without culture.

Two years later, Jessica shifted focus to developing methods for viral diagnostics and mentored her postdoc, Zach Stromberg, who participated in DisrupTECH and the UC/LANL Postdoc Entrepreneur Fellowship. This led to the assessment of whether a computational pipeline the team was developing, termed FEVER for Fast Evaluation of Viral Emerging Risks, could detect viruses more accurately than current market standards. The project started with influenza and then expanded in 2020 to address the COVID-19 pandemic.

## Technology Advancement

Armed with new skills in customer discovery and building business models, the CBMA team refined their proposals which resulted in DTRA (led by Harshini Mukundan) and LDRD funding (led by Jessica). The funding has supported assay development for the detection of select agent pathogens (DTRA) as well as viruses (LDRD), and exploration of alternative sensing strategies.

The FEVER pipeline received TED Pathfinder funding, the first LANL funding grant directed at COVID-related research, to apply the tool to generate assays that distinguish common cold SARS-like coronavirus infections from SARS-CoV-2, the viral cause of the COVID-19 pandemic. This resulted in patented COVID-19 probes that are more robust in the face of viral mutation than those developed by the CDC.

## Impact

Through Jessica and Zach's participation in these entrepreneur programs, the CBMA team has embraced identifying customer and market needs to help focus R&D efforts. Jessica established a partnership with Pattern Computer and Cantor BioConnect to evaluate the feasibility of spectral scanning of saliva as a rapid method for detecting COVID-19 infections in patients at the point-of-care.



### Timeline:

**2017:** DisrupTECH, Best Pitch - Postdoc

**2018:** UC/Los Alamos Entrepreneurial Postdoc Fellowship

**2018:** R&D 100 winner, Universal Bacterial Sensor (led by Harshini Mukundan)

**2018:** LDRD funding for viral mosaic biosensor

**2019:** DTRA funding for fieldable bacterial vs. viral diagnostics (led by Harshini Mukundan)

**2020:** Mentor of Zach Stromberg, UC/Los Alamos Entrepreneurial Postdoc Fellow

**2021:** Pattern Computer and Cantor BioConnect collaborations

*"[PI Engagement Programs] allow you to ask the right questions, hone in, and get down to a solvable problem... now when writing proposals, we always try to think about who the end user is."*

*- Jessica Kubicek-Sutherland*

# Outstanding Partnership

Matt Newell

## Innovation

The International Atomic Energy Agency (IAEA) is currently using an instrument called the MiniGRAND in support for safeguarding nuclear material. The instrument has become obsolete and can't be built anymore. The Los Alamos NEN-1 Technology Development team, led by Matt Newell, proposed developing a replacement instrument for the MiniGRAND that performs the same low current measurements with the added feature of conforming to the IAEA encryption data transfer protocol. The goal was to demonstrate the technology advancement in partnerships with the Department of Energy National Nuclear Security Administration (DOE-NNSA), IAEA, and industry, then transfer the technology to an industry partner to build and deploy the technology to the IAEA. Matt's innovative work on nondestructive assay electronics development and commercialization has had a significant impact on the advancement of nonproliferation technologies in the area of nuclear safeguards.

### Timeline:

- 2015:** Development of UDCM funded by NA241 safe guard's technology sg10
- 2017:** Built prototypes and sent to the IAEA for testing and evaluation
- 2019:** Received Technology Maturation Funding to put together a drawing package with all the details of the circuit board, a user manual and development model
- 2020:** CAEN licensed the technology from Triad, LLC

## Technology Advancement

Matt Newell and the NEN-1 Technology Development team developed the Unattended Dual Current Monitor (UDCM), an instrument used to measure very low currents commonly produced when measuring nuclear material in a process plant. The UDCM is an ideal solution for current measurement needs, such as ion chamber gamma measurements. This data acquisition system simplifies hardware requirements for current applications and provides added reliability, flexibility, and compatibility. UDCM is lightweight, is manufactured using commercial off-the-shelf (COTS), and features a modern Internet-of-Things (IoT) design. Matt received Technology Maturation Funding to develop the documentation needed to transfer the UDCM to the private sector. He completed a developer's manual with step-by-step guides to setup the new instruments and a drawing package for a commercial partner to reproduce the instruments.

## Impact

CAEN, a company with strong foundational knowledge of nuclear measurement instrumentation in developing Radiation Measurements Systems and Spectroscopy Solutions, successfully licensed the Triad, LLC UDCM technology. CAEN is collaborating with Los Alamos to finalize the hardware and software development to commercialize the technology with the IAEA and serve as the supplier for government and nuclear safeguard community. These partnerships have enabled the Laboratory to participate in the scale-up to commercial production, while protecting the pedigree and quality assurance of the technology. CAEN is looking to build strong partnerships with leading labs and believes taking a Los Alamos technology to market is "a badge of honor."

*"I definitely recommend partnering. It's rewarding to take your science and new development and put it out there in the commercial industry and see it be used to solve problems throughout the world."*

- Matt Newell



# Next Big Idea

*Los Alamos National Laboratory,  
Jenike & Johanson*

## **Innovation**

Increasing the production and use of biofuels is a national objective for renewable, cleaner energy. It is imperative to increase the operational reliability of bio-refineries to make bio-derived fuels cost-competitive with fossil fuels. One of the main hurdles is improving the conversion of biomass, such as corn stover, into ethanol. Corn stover is known for having poor processing properties for bulk solids handling and transport. One of the biggest issues is moisture content causing costly system plugging and downtime at bio-refineries. To address these system issues, Los Alamos and Jenike & Johanson have combined “smart” transfer chutes with acoustic moisture sensors to revolutionize biomass processing to prevent plugging process lines that cause downtime.

## **Technology Advancement**

With over 55 years of transfer chute design experience, Jenike & Johanson (Jenike) has evolved the standard stationary chute into a dynamic transfer chute design. Jenike has developed and integrated proprietary software with automated hopper and chute designs specifically for industrially relevant material properties of corn stover. Los Alamos’ novel acoustic sensors was the missing component that can provide continuous moisture monitoring capabilities in the target moisture range known to be problematic for reliable bulk solids handling and transport. The sensor provides real-time monitoring, enabling the “smart chute” to detect and divert the high moisture content corn stover to a separate location be dried out and used later. The acoustic sensors can be applied throughout the handling train to reduce costly system plugging and greatly improve the operational reliability.

## **Impact**

This integrated system will aid in solving current bulk solids handling and transport issues while also ushering a renewable carbon source to reduce the use of dirty fossil fuels, lower emissions, and lessen climate change. Los Alamos and Jenike have developed the proof of concept. By the end of the year, the goal is to couple the sensor with the Jenike smart chute design. If this proves successful, Jenike plans to license the Los Alamos technology, fabricate the new system internally, and commercialize it. After successfully designing and deploying the smart chute system for bio-refineries, Jenike hopes to advance the technology for additional industrial applications.

### **Timeline:**

**2017:** Jenike & Johanson and Los Alamos started to talk about potential partnership

**2018:** Submitted a proposal for the Feedstock-Conversion Interface Consortium (FCIC) Directed Funding Opportunity (DFO)

**April 2019:** Los Alamos entered into a Cooperative Research and Development Agreement with Jenike & Johanson

*“The ability for us to realize something in the end to take it to industry and change something in the industry has been very rewarding.”*

*- David Craig  
Vice President Director of Engineering Jenike & Johanson*



# TECHNOLOGY TRANSFER EXCELLENCE

*Los Alamos National Laboratory and Qrypt, Inc.*

## Innovation

The Los Alamos Quantum Random Number Generator (QRNG) is a hardware-based high-performance Random Number Generator capable of generating 200 Mbit/s or more of true random numbers. Like flipping a coin, it is very much random and essential for information security like encrypting data on the internet, checking email, or purchasing something from an online vendor. The device harvests entropy from fluctuations in an optical source that arise from quantum mechanical properties of light. Qrypt, Inc., a company launched in 2017, began making strategic investments and developing partnerships in cutting-edge quantum hardware. One of those key investments was licensing QRNG and subsequently collaborating with Los Alamos researcher Dr. Raymond Newell -- (MPA-Q) to create high-quality random keys at scale.

### Timeline:

**February 2020:** Qrypt, Inc. signed an agreement with Los Alamos to license specific Triad, LLC QRNG intellectual property.

**November 2020:** Los Alamos entered into a Cooperative Research and Development Agreement with Qrypt to further develop and transition the QRNG technology to the company.

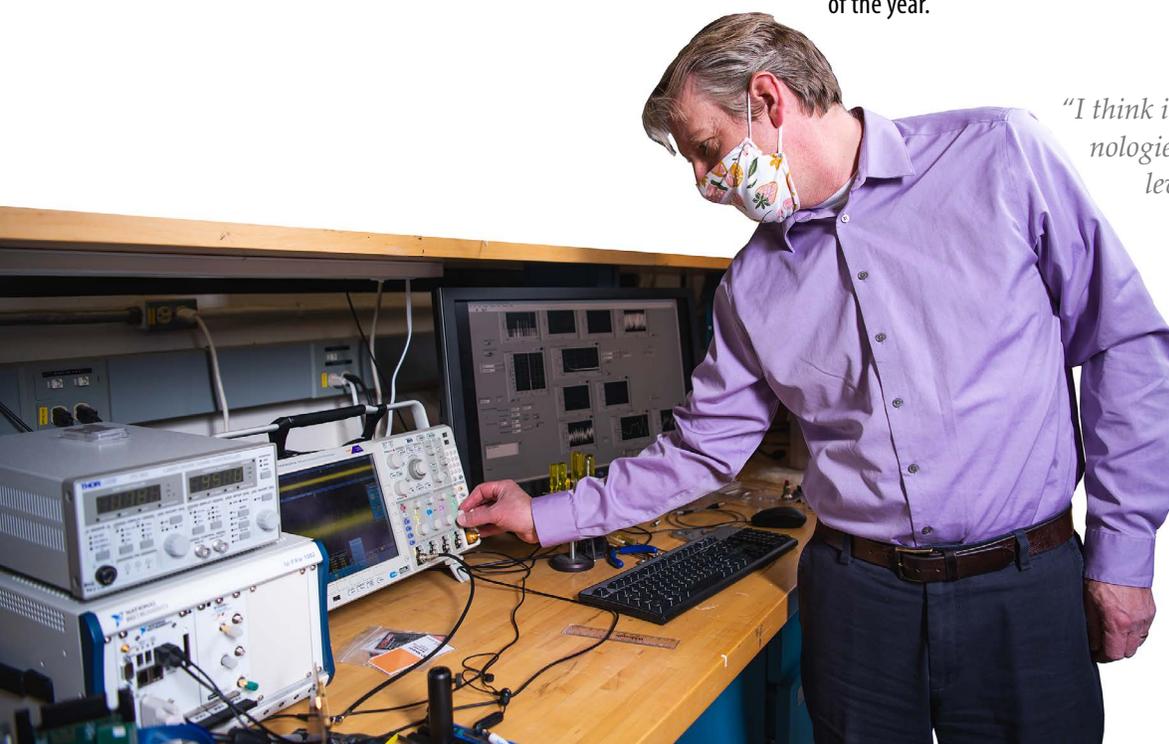
## Technology Advancement

The Los Alamos QRNG can satisfy the demands of even the highest-performance crypto-systems. This device can be used as a dedicated random number generator or deployed as the core component of an Entropy-as-a-Service network device. Qrypt's goal is to enable secure encryption for the modern age. Qrypt is leveraging cloud infrastructure, new algorithms, and high-rate QRNGs. They have built the first generation of Entropy-as-a-Service using the same global infrastructure, which makes QRNGs available to any internet connected device. Qrypt distributes those random numbers via cloud services, enabling more secure cryptography for all applications and clients like banking and critical infrastructure. In order to do this at scale, Dr. Newell is working closely with the Qrypt engineers testing the circuit and optical devices and providing feedback.

## Impact

Qrypt licensed the Triad, LLC QRNG technology to commercialize it for their cloud based Quantum Entropy-as-a-Service platform. Los Alamos continues to work with Qrypt under a Cooperative Research and Development Agreement (CRADA) to test the QRNG technology and deploy it into the marketplace. Together they're working to make the QRNG technology a practical device that can sit inside a computer in a data center. They are starting to build their first prototype and see validation of their work. The goal will be to start scaling and commercializing the technology by the end of the year.

*"I think it's essential that as the technologies we develop reach a certain level of technical maturity, we need to have a path forward out of the Laboratory."  
- Raymond Newell*



# Notable New Mexico Start-up

*Los Alamos National Laboratory,  
Space Nuclear Power Corporation*

## Innovation

Space Nuclear Power Corporation (SpaceNukes), a new start-up located in Los Alamos, licensed the Triad, LLC "KiloPower" space reactor technology to develop and produce nuclear reactors to power deep-space exploration and human habitats on the Moon and Mars. SpaceNukes was founded on two fundamental beliefs: 1) the future of humankind is inevitably linked to our exploration and expansion into space, and 2) nuclear power is essential for the future, on Earth and in space. The company's goal is enabling the successful deployment of space nuclear systems anywhere solar power or other power sources are not practical. SpaceNukes is focusing on building reactors for the planetary surface on the Moon or Mars and providing power for space crafts and propulsion.

### Timeline:

**2012:** Los Alamos and NASA Glenn Research completed a proof-of-concept test in four KiloPower space trips.

**2013:** Los Alamos and NASA won an R&D 100 Award with KiloPower.

**2020:** SpaceNukes licensed the "Kilopower" space reactor technology from TRIAD, LLC.

## Technology Advancement

The SpaceNukes founders invented, built, and tested KiloPower as researchers at Los Alamos National Laboratory. It is a small, lightweight fission power system capable of providing various ranges of power depending on the need. The new SpaceNukes reactor is a low enriched uranium version of the base Kilopower technology. SpaceNukes is proposing to develop this 20-kilowatt reactor to be located on the lunar surface to power a habitat for astronauts. SpaceNukes is starting small in developing their new reactor as the first step in a long climb to more advanced reactors in space.

## Impact

SpaceNukes is pursuing opportunities with NASA for a lunar surface reactor and the U.S. Air Force/Space Force for reactor concepts for cislunar space. The goal in working directly with these two federal agencies is developing infrastructure to demonstrate the technology and business model to interest private-sector partnerships and investments. One of SpaceNukes' key strategies is to leverage the resources that are available in the state of New Mexico. Their vision is to utilize the many New Mexico space assets along the I-25 corridor to develop their reactor for space applications. SpaceNukes has the ability to build and test the technology utilizing the Space Port, White Sands, Air Force Research Lab, Los Alamos and Sandia National Laboratories.



*"There are not a lot of places on the planet that have the resources that New Mexico does, so we have got to tap into it. New Mexico has a lot of experts in what we do here and the state should capitalize on what we're good at."*

*- Patrick McClure, COO  
Space Nuclear Power Corporation*



# R&D 100 Awards and Special Recognition Awards



**Adaptive DNA Storage Codec** .....



**CICE Consortium: Providing extensive, accurate sea ice modeling across scales** .....

Partners: CICE Consortium organizations



**EpiCast: Simulating epidemics with extreme detail** .....



**ERDE: Earth's-field Resonance Detection and Evaluation devices** .....



**Mochi: Providing scalable data services for high-performance computing** .....

Partners: Argonne National Laboratory, Carnegie Mellon University, and The HDF Group



**PEGASUS: Portable Engineered Sensor with Automated Sampling** .....



**QED: Quantum Ensured Defense of the Smart Electric Grid** .....

Partners: Oak Ridge National Laboratory and EPB



**Smart Tensors AI Platform** .....



**Terra Spotlight: A new paradigm in rapid change detection using satellite images** .....



Technology Readiness Initiative (TGR) addresses the gap of knowledge transfer and technology advancement when a New Mexico business licenses a laboratory technology or engages in a research partnership. It gives these New Mexico businesses the ability to leverage research and technology development from Los Alamos and Sandia national laboratories to expedite product development.

TRGR assistance accelerates technologies past the invention stage into products and services to grow the technology-based economy.

Please visit [www.nmtrgr.org](http://www.nmtrgr.org) to learn more

## Hydrogen Fuel Cell Catalyst Analysis

Pajarito Powder is a designer/manufacturer of hydrogen fuel cell catalysts in New Mexico. Through technology readiness assistance provided at Los Alamos National Laboratory, those catalysts were observed using a suite of electrochemical evaluation and material characterization tools. Los Alamos assisted Pajarito Powder in identifying catalyst degradation mechanisms. Pajarito Powder is now utilizing project outcomes to aid their development of a new generation of fuel cell catalysts to surpass state-of-the-art performance requirements.

## Solar Window Space-Environment Simulations

UbiQD is an advanced materials company powering impactful innovation in agriculture, clean energy, and security. Their quantum dots enable products that harness the power of color and light. Through this project, UbiQD is leveraging Los Alamos National Laboratory's Space Instrument Realization group's extensive space instrumentation capabilities to test their product component in simulated space environments. UbiQD will leverage project outcomes for future product component improvements.

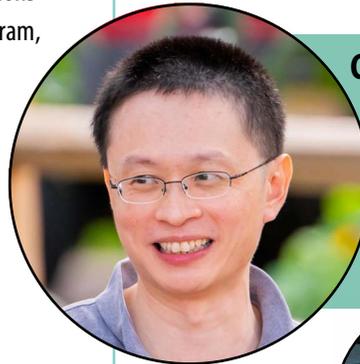


# New Mexico Lab-Embedded Entrepreneur Program



New Mexico Lab-Embedded Entrepreneur Program (NM LEEP) offers unique access to national lab resources to build solutions for the nation's toughest problems. Over the two-year program, New Mexico LEEP Fellows receive:

- Annual stipend to locate and build their company in New Mexico
- Support from Los Alamos National Laboratory scientists and engineers to collaborate, test, and validate technology and early product development.
- Access to an experienced network of mentors and business resources in market sectors relevant and specific to New Mexico LEEP innovators' needs to grow
- Scale-up curriculum tailored for the innovators in product development, manufacturing, financial projections, investor readiness, and company scaling.



**Cliff Chan**  
OAM Photonics  
San Diego, CA

LOS ALAMOS PRINCIPAL INVESTIGATORS:



**Abul Azad**



**Anatoly Efimov**

**MPA-CINT: Center for Integrated Nanotechnologies**

**OAM PHOTONICS' OBJECTIVE:**

OAM Photonics is addressing the bottleneck of integrating photonics and electronics to develop superior and more sensitive imaging sensors critical for applications in autonomous transportation, robotics, and free space communications.

**NM LEEP COLLABORATION WITH LOS ALAMOS NATIONAL LABORATORY:**

Demonstrate single pixel LiDAR system performance integrated with micro-processor, photonic, optical, and electrical design components.

Exercise and document product development procedures (fabrication, characterization, and optimization) which OAM Photonics may subsequently use to advance to a multi-pixel implementation.



**Srikanth Kodeboyina**  
Blue Eye Soft, LLC  
Grier, SC

LOS ALAMOS PRINCIPAL INVESTIGATOR:



**Yue Chen**

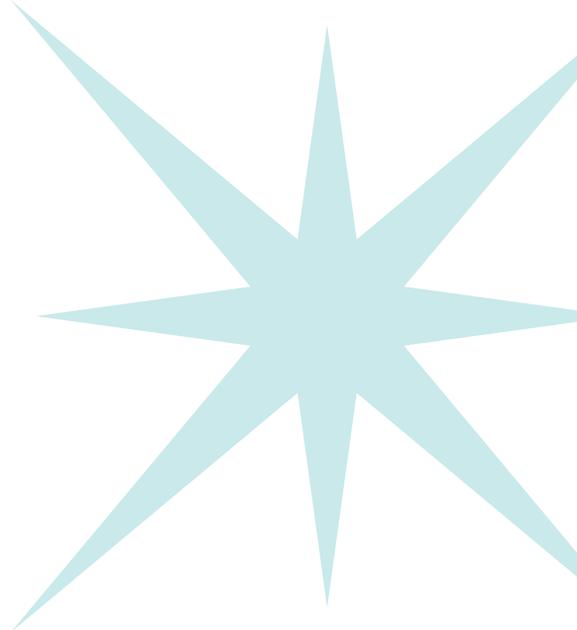
**ISR-1: Intelligence & Space Research**

**BLUE EYE SOFTS' OBJECTIVE:**

Blue Eye Soft is building its Space Anomaly Forensics & Environment Resolution (SAFER) platform to fuse and analyze volumes of historic data to develop predictions of space weather impacts to provide satellite operators early warnings and alerts of space weather events.

**NM LEEP COLLABORATION WITH LOS ALAMOS NATIONAL LABORATORY:**

This collaboration seeks to commercialize and operationalize LANL's PreMevE software to enable a commercially viable space weather forecasting and warning product for existing and future customers (e.g., satellite designers and operators, utilities providers, and insurance companies). Blue Eye Soft will integrate LANL's PreMevE 2.0 code into its SAFER platform and LANL will provide technical inputs on the final space weather product(s).



**Kristina Trujillo**  
T-Neuro  
Placitas, NM

LOS ALAMOS PRINCIPAL INVESTIGATOR:



**Babs Marrone**

**B-11: Bioenergy & Biome Sciences**

**T-NEURO'S OBJECTIVE:**

T-NEURO is developing a biomarker for Alzheimer's Disease that can be detected in blood, offering a much more effective and affordable diagnostic than costly MRI imaging and painful Cerebral-Spinal Fluid sampling.

**NM LEEP COLLABORATION WITH LOS ALAMOS NATIONAL LABORATORY:**

LANL will work to validate and potentially work towards the improvement of the existing T-neuro's Alzheimer's Disease detection assay using a combination of capabilities, including flow cytometry, antibodies, yeast display, and expertise in sequencing and library analysis.

# METRICS

FY 2019

FY 2020

## LICENSES

Active Agreements  
**380**

Funding  
**\$2.25M**

Active Agreements  
**380**

Funding  
**\$2.2M**

## PATENTS

**48**  
Applications

**86**  
Issued

**49**  
Applications

**81**  
Issued

## CRADAs

Active Agreements  
**68**

Funding  
**\$6.6M**

Active Agreements  
**65**

Funding  
**\$4.5M**

## NFE

Active Agreements  
**76**

Funding  
**\$22.6M**

Active Agreements  
**96**

Funding  
**\$16.5M**